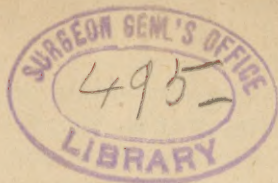


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A CONSIDERATION OF THE KNEE-JERK
SYMPTOM.*

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About two years ago I became interested in investigating the true value of the knee reflex, or knee jerk, as a symptom of disease. Since then I have gradually accumulated observations, and, to some extent, have investigated the literature of the subject. My study has been, of course, chiefly upon the Insane Asylum population, but I shall try to condense into a fifteen-minute review only those results which will be of more general interest.

How does the subject stand? Let us see. We have a symptom easily obtained and studied by any physician at the most casual interview. If it is of any value at all, it should be a part of the means of examination by every physician. The study of the symptom to find out its indications, led out into many complications, but only the main ideas may be mentioned in this brief discussion. Let us review the subject by considering its limitations and its conditions in health, first, and then follow with a short outline of its pathological meanings.

As a brief preliminary, a definition is needed. We may designate the knee jerk, or knee reflex, as the amount of jerk, or reflex action, obtained by tapping the patella tendon or its adjacent muscles when on slight tension. (All discussion as to whether it be a tendon action or muscle action is waived, as not pertinent to this discussion and as yet unsettled.)

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At the very beginning of this study I found that, rather surprisingly, there was no scale by which to measure the degree of this phenomenon. The only terms in use were the words "absent," "normal," and "exaggerated." At least this was so in all of the clinical reports I then found.

I at once constructed for my own use a scale as here represented:

0. Entire absence.
1. Scarcely discoverable.
2. Quite slight.
3. Sluggish.
4. Somewhat below normal.
5. Normal.
6. Exaggerated somewhat.
7. Exaggerated considerably.
8. Exaggerated excessively. Can get on muscle above knee.
9. Exaggerated extremely. Can get by slight tap of little finger, and upon muscle six inches above knee. Frequently ankle clonus.
10. Most extreme. Usually ankle clonus.

This table furnished a basis for comparative study. It still relied for exactness on my personal judgment, but with such limits as made its knowledge vastly more exact.

I found next that in some persons the knee jerk was quick and short; in others, longer but slower. The only way I found to overcome this error was to make an average and allow a certain amount of quickness to compensate for length of jerk and still count as normal. That is to say, I would count some reflexes as normal on account of a quick response, though the leg moved but a slight distance. The fatness and weight of the leg seemed to militate against length of movement also.

These points I have failed to find definite mention of, and yet I had to make allowance for them from the outset.

The next preliminary question was in regard to the best position. It has been supposed to be that position

in which the person sits upon the edge of the table, with the legs hanging freely down. From my own experience, however, I would express a decided preference for the ordinary position of crossing the legs while sitting in an ordinary chair, and have usually so investigated. These preliminary questions I worked out during the early part of the examinations of insane patients, the examinations being all of a clinical character. In pursuit of this investigation I have examined some 600 patients, insane, and about 100 healthy people who were chiefly employees at the hospital.

Of the results of this examination among different classes of the insane I shall only make slight mention, my purpose at this time being only to excite interest in the symptom, and to indicate its general significance as a nervous symptom. The sound foundation could first be laid, of course, only by some consideration of healthy people. This the 100 cases of healthy people is meant to furnish.

In 100 young and supposedly healthy people I find only one totally absent reflex, a young man healthy and under observation one year. There are 11 more, however, marked "1" or "2" on my scale, so nearly absent as to be found with difficulty. I also find two young women, also attendants and healthy, with distinct and decided ankle clonus and extreme exaggeration. Estimates have been made that there are as many as 2 per cent. of healthy people having absent reflex. BERGER claims 32 cases in 1,409; ZENNER (in 1886) 2 cases in 932. Some examinations of school children show higher percentages. The following table will show the results obtained by me:

100 HEALTHY PERSONS.

Degree of reflex.	Number of cases in 100.	
0.....	1	
1 and 2.....	11	
3.....	8	
4, 5 and 6.....	62	normal.
7.....	9	
8.....	7	
9.....	2	with ankle clonus.

But JENDRASSIK's publishing of the method of reinforcement has reduced the per cent, so that it seems safe to calculate that not over 1 per cent of healthy people have absence of patellar reflex, and probably less, and, as BROWER recently says, in these cases the reflex did *not disappear*, but was always absent. This method of reinforcement of the knee jerk needs mention, as it is of considerable importance. It consists in having the patient do some muscular act, such as clasping the hands, at the same time or at an instant before the tendon is tapped. I find that a clinical improvement is to ask the patient to do it rhythmically, say once every two or three seconds. You can then easily tap the tendon simultaneously with the act. The effect of this accessory act is to materially increase the knee jerk, and at times will demonstrate its existence when it would otherwise be absent.

But, besides this variation in different people, it has been found that in the same individual the various influences affecting only superficially the nervous symptoms are indexed very accurately by the extent of the knee jerk. LOMBARD, in 1887, BOWDITCH, 1888, WARREN and, lately, NOYES, 1892, have made profound physiological studies and report changes of the knee jerk as follows:

- Increased in the morning.
- Increased after meals.
- Increased after mental activity.
- Increased in the cold.
- Increased after voluntary movements.
- Increased after strong sensation.
- Increased after strong emotion.
- Lost in sleep.

They made their examinations elaborately with the one examined lying on the side in a most relaxed position, and with elaborate and complex mechanism to record each stroke, and to measure its effect. Nor were these effects uncertain; they were almost sure to occur if the causes acted. However, notwithstanding the truth of all such experimentation, I have found the knee jerk so nearly uniform from day to day as to

check with fair accuracy, and I have, in clinical work, assumed it to be constant.

With these preliminaries to the full understanding of the symptom we finally reach the variation of knee jerk as a pathological symptom. And through the confusion of considerable experimentation, I think we can discern its variation as of sufficient practical significance to justify at least this much of consideration.

In beginning a study of its pathological significance we would first try to formulate in generalized statement the pathological causes of variation in the knee jerk phenomena. We could, perhaps, state this as follows: "Anything impairing the reflex arc between the knee and its centre in the lumbar portion of the cord tends to abolish it, and anything tending to interfere with the (supposedly) inhibiting or controlling influence of the cerebrum increases it; while anything impairing the lateral portion of the cord tends to exaggerate it in like manner." In general, both extreme exaggeration and complete absence indicate disease, while lesser changes indicate at least disturbing causes which may or may not amount to actual disease.

In the following mention of diseases we shall attempt a hasty grouping of prominent diseases, rather than any exhaustive consideration.

NEURASTHENIA. I would begin these by designating neurasthenia as a disease in which there is an exaggeration of the patellar reflex.

In neurasthenia, as a disease, or in the neurasthenic condition as a symptom of other diseases, there will be found this tendency towards exaggeration of action of the knee jerk. And, by defining neurasthenia as a kind of exhausted state of the nervous system in which mental depression and mental irritability go along with peripheral sensations of the extremities in internal organs, we can see this as logically only a local sign of a generally exhausted and irritable nervous state.

This exaggeration in the disease seems vaguely but commonly, attributed to the impairment of the inhibiting or controlling influence of the cerebrum. Inas-

much as *neurasthenia*, or the lighter forms of it, are so common, and as (further) this symptom is so easily tested, it cannot but be valuable as a confirmatory sign. This exaggeration is, I think, only moderate in amount, usually amounting to 7 or 8 on our scale, but growing higher as the nervous derangement is more profound.

ALCOHOLISM. I have had occasion of late to make quite a number of physical examinations in chronic alcoholism, and have been impressed with the marked *neurasthenic* condition there present. Instead of the moderate knee jerk of ordinary *neurasthenia*, there are frequently the quite extreme degrees, together with an approach toward a *paretic* condition, by reason of the presence of some incoordination of the legs or arms or other motor impairments. In alcoholism, then, I would put down the knee jerk as commonly exaggerated, and as occasionally exaggerated to an extreme degree, and if so, in accordance with its degree indicative of the *neurasthenic*, possibly *paretic*, condition brought on by the continual use of alcohol.

As a sub-heading under alcoholism, we would merely mention the tendency of morphine eating, chloral-ism and drug taking generally, to bring on a *neurasthenic* condition similar in kind. The exaggeration of the knee jerk symptom can be thus said to be, to an extent, a measure of the nerve exhaustion, or the nerve irritability of the *neurasthenic* condition.

GENERAL PARESIS. In the early stage of general paresis, or "softening of the brain," as frequently called, we have as a quite frequent and quite significant symptom this exaggeration of the knee jerk. I have before expressed my conviction in regard to it in about this form: If very exaggerated patellar reflex is present in a suspected case of paresis, it is valuable, but valuable as a confirmatory symptom only; not pathognomonic, but quite significant as a symptom in favor of making a diagnosis of this fatal and most distressing malady. Of course, any consideration of the other symptoms of this disease would be out of place here.

SPASTIC SPINAL PARALYSIS. In spastic spinal paraly-

sis, or lateral sclerosis of the cord, we have the most prominent disease of the cord which has marked the extreme exaggeration of the knee jerk.

Lateral tract degeneration is *distinctly* productive of this result. This is probably due to the loss of the inhibitory cerebral action conducted through these columns. At any rate, it is a very marked symptom, and one of diagnostic value, as well.

AMYOTROPHIC LATERAL SCLEROSIS. In amyotrophic lateral sclerosis, also, the extremely exaggerated knee jerk maintains, and from the same cause as the following, namely, the sclerosis of the lateral tract.

EPILEPSY. Epilepsy has been supposed frequently to have as an accompaniment exaggeration of the knee jerk, and from its supposedly cortical origin I would think it reasonable to expect. I have to confess, however, that the examination of 25 cases, all of them showing some little or great mental degeneration, does not exhibit a single case of extreme exaggeration, and as a whole, they average as nearly normal as any group. I am, therefore, disposed to suspend judgment.

HYSTERIA. As causative of an exaggerated action of this reflex, I would also mention hysteria as claimed to tend toward occasional exaggeration. ZIEHEN records 20 per cent. of hysterical cases as having ankle clonus, but to what extent the hysteria must be carried is not said. We can only state that there is a frequent tendency in this state toward an exaggerated reflex.

I would group together some other causes of exaggeration as at times of value. Tetanus, and some poisons like strychnine, spinal meningitis, occasionally, and spinal myelitis, when the focal lesion is in the lateral columns. In short, in all the rarer lesions happening to affect chiefly the lateral columns there will be this sign.

ABSENT REFLEX. Next comes a class of cases in which the reflex is diminished or lost.

LOCOMOTOR ATAXIA. Foremost and best known among them is locomotor ataxia. Few, indeed, are the cases in which this important sign fails to be found. The observations of the last four or five years, however,

have established that there are cases in which the patellar reflex is present. This has been thought discouraging to it as a symptom, but the cases seem so rare that it is only needful to bear them in mind as *possible*, and in doubtful cases search for confirmatory signs. I would make a note in passing, however, to the effect that there seems comparatively unnoticed by writers the idea that, if a total absence is noteworthy, a partial loss is significant in proportion to the amount of motion diminished. I have not experience to fully satisfy myself of the correctness of this seemingly reasonable theory, but in general it seems to be true.

GENERAL PARESIS. I have found an absent reflex in general paresis in 12 out of 54 cases, in personal examination, in the same form as in locomotor ataxia. This is not hard to account for, however, when we consider the close alliance of the two troubles. Indeed, in some cases, there seems a mingling of the two diseases, and undoubtedly a mingling of the anatomical lesions, producing the two separate troubles. The results of the examinations of paretics is appended.

GENERAL PARESIS.

Reflex.	No. cases in 53.
0.....	12
1 and 2.....	1
3.....	3
4, 5 and 6.....	5 normal.
7.....	3
8.....	18
9 and 10.....	11

53 Total.

PERIPHERAL NEURITIS. In peripheral neuritis, affecting the lower limbs, we would find lessened or absent patellar reflex. In this case the lesion impairs the reflex arc by impairing the conducting nerve, the effect being the same. Its loss, then, in connection with rapid onset of paralysis and atrophy (and not incoordination), is a very great diagnostic help in outlining this disease.

MYELITIS. A generalized myelitis would, of course, act to abolish reflex by destroying the integrity of the reflex arc in the cord.

Finally, we have a varied group of causes occasionally diminishing or abolishing this reflex. Pachymeningitis of the cord, interfering by pressure with the anterior or posterior columns, such rare things as tumors, hemorrhages and other lesions of the cord, may be mentioned. In an analysis of 29 cases of injury to the cervical and dorsal regions. THORBURN this year concludes that in total traverse lesions the reflexes are totally abolished, while in partial lesions they are retained and possibly exaggerated. Diabetes should also be mentioned as occasionally abolishing the knee jerk, and spinal meningitis as usually doing the same. Lesions of the cerebellum have more recently been stated by FERGUSON to abolish the reflex.

INEQUALITY OF REFLEXES. All authorities seem to agree that this is never found in health. Yet, as far as I can learn, its localizing power is not so great as its absence. Still, it is very important, as it is a symptom apt to occur in obscure cases.

APOPLEXY. After apoplexy the paralyzed leg is found to have exaggerated knee jerk. This is found right after the stroke, but later will develop permanently as an accompaniment of the secondary degeneration following. It seems correct to use this sign in examining apoplexy, embolism or brain tumors.

Excluding the cases of apoplexy, with their clear history, we find cases in which its significance is important, though the diagnostic value be small. In one case it was used as a deciding point for an obscure vascular brain lesion, as against general paralysis, many motor symptoms of which were present. But, on the other hand, it has been considered as indicative of general paralysis, when present with other brain symptoms.

In cases of insanity, however, which do not have even the suspicion of general paralysis, there is found occasionally an inequality, but with the extreme probability, always, of some obscure lesion of the brain or cord. I have notes of 15 cases of unequal reflex gath-

ered while collecting the 700 of the table. Of these in no one was the patient sane and healthy. Three had general paralysis of the insane; three had old hemiplegic attacks; one had chronic alcoholism; two had obscure mental signs of brain failure, and the symptom was of considerable value in diagnosis; one had the probable vascular brain lesion. The symptom, then, is frequent enough to deserve a note, and, first excluding apoplexies and injuries, is of great diagnostic significance, as indicating some lesion of the central nervous system.

We have, in a hasty way, tried to indicate the leading points of significance in the knee jerk symptom. In the following table we have grouped into tabular form the variations here considered.

KNEE JERK SYMPTOM.

In Health:

Absent in rare cases—never was present in these cases.

Sluggish in a good many—no cause known.

Exaggerated in a very few.

Seems to diminish in old age.

Exaggeration of reflex:

In neurasthenia—moderately.

In chronic alcoholism—moderately to excessively.

In general paresis—extremely so in 29 out of 54 cases.

In epilepsy—in 60 per cent. of cases (ZERNER).

[My own cases about normal.]

In spastic spinal paralysis—typically and extremely exaggerated.

In multiple sclerosis—usually if lateral columns are affected (BRAMWELL).

In tetanus, strychnine poisoning, etc. (JAMIESON).

In hysteria—20 per cent. of cases have ankle clonus (ZIEHEN).

Absent or diminished:

In locomotor ataxia—absent, with rare exceptions; usually lost early.

In general paresis—absent in 12 cases out of 54 noted.

In peripheral neuritis—diminished or lost.

In myelitis—usually modified or abolished (RANNEY).

In spinal meningitis —usually lost, unless lumbar region be unimpaired.

In diabetes —sometimes lost.

In cerebellar lesions (FERGUSON).

Unequal:

After apoplexy, also emboli or other lesions.

Injury to hip or to nerve in leg —possibly.

In general paresis —in 12 out of 54.

In other insanity —with obscure meaning.

Possibly from rare localized injuries to cord.

In conclusion, then, what have we found? We have found the knee jerk in healthy people differing greatly, occasionally being found completely absent, and occasionally extremely exaggerated. We have also found that it varies in the same person with all strong sensations and emotions. This is somewhat discouraging at the outset. Further study, however, shows it to be fairly steady in the same person, if healthy, and that any change in it is significant, if the constant variation from normal is not; also, that the extremes of variation are almost invariably of significance in either case, that significance to be interpreted only by the context furnished by the accompanying symptoms.

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